

## A Scale for E-Content Preparation Skills: Development, Validity and Reliability<sup>1</sup>

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### Abstract

*Problem Statement:* For an effective teaching and learning process it is critical to provide support for teachers in the development of e-content, and teachers should play an active role in this development.

*Purpose of the Study:* The purpose of this study is to develop a valid and reliable Likert-type scale that will determine pre-service teachers' e-content preparation skills according to the criteria determined by the Ministry of Education. The scale developed over the course this study is intended for use not only by pre-service teachers but also in-service teachers to determine their e-content preparation skills.

*Method:* The purposeful sampling method was employed to select participants. For exploratory factor analysis, participants consisted of 226 pre-service teachers from the Department of Computer and Instructional Technologies at a state university located in eastern part of Turkey. In addition, 588 teacher candidates were randomly selected for confirmatory factor analysis. When analyzing the scale's validity and reliability, respectively, convenience according to factor analysis, item analysis, exploratory factor analysis, Cronbach's alpha and split-half value calculation was applied.

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*Findings:* The validity and reliability tests of the scale, which were developed in accordance with the criteria of e-content published by MEB, were performed on teacher candidates. Experts inspected the draft scale prepared during the validity study, and the items that were identified as inappropriate and damaging to the appearance of validity were extracted. According to factor analysis, those items with a load value of less than 0.45 and items with a high load value in two items were extracted from the draft scale. The scale showed a seven-factor structure after repeated exploratory factor analysis; these seven factors provided an explained variance for 74.23% of the scale. Considering the acceptable levels of goodness for fit indexes acquired by confirmatory factor analysis, we can conclude that the seven-factor construct based on exploratory factor analysis results was confirmed. The internal consistency coefficient (Cronbach's alpha) was determined as 0.98. The analyzed item total correlation changes between 0.52 and 0.80.

*Conclusion and recommendations:* In conclusion, the survey items possess high reliability to evaluate the same behavior based on the gathered data.

*Keywords:* E-Content, Pre-Service Teachers, Validity and Reliability, E-Content Preparation Skill.

## Introduction

Changes and developments in the informatics and communication technology field, as in any other field, affect the field of education. New methods appear in education due to the effects of new technology. One such method is e-learning. E-learning refers to an educational method that takes place through the use of informatics and communication technologies, providing independence in terms of time and place (Sun, Tsai, Finger, Chen and Yeh, 2008). With e-learning, not only education methods but also course materials were transformed. To provide effective education in e-learning environments, educational materials must provide the required components such as text, sound, simple graphical presentations, video presentations, animations, simulations, games, test systems and feedback-enhanced interaction (Friesen, Fisher and Roberts 2001).

The base of e-learning is e-content (Kumar and Kushwaha, 2010, p. 181), which is computer-supported content that exists and is created in an electronic environment, developed to be compatible with the internet environment, providing it with convenience (Kultur, Albayrak, Oytun and Tonguc, 2003). In other words, e-content is storable and workable education sources that can be used with both formal, widespread education programs and personal education and are created with digital technology (Kollias, 2007). This emerging educator's tool, course materials compatible with an electronic environment or e-content, is one of the finest examples in education of making individual learning easier (Bayrakçı and Demirbas, 2013; Duraisamy and Surendiran, 2011). While e-content improves and shortens the

teaching and learning process, it also helps students to understand scientific topics (Pinter, Radosav and Ćisar, 2010). In the teaching and learning process, the use of e-content supports teachers by enriching their instructional materials (Eshlaghy and Kaveh, 2009); thus, educational institutions exert effort in designing e-content (Wassan, 2015). Specifically, electronic research reports, electronic course modules, electronic course notes, electronic magazines, electronic books, electronic course slides, animations, sounds, videos, pictures, graphics, virtual laboratories and search engines are sources of e-content in education (Shiratuddin, Hassan and Landoni, 2003).

E-content is a product of the e-learning process (Duraisamy and Surendiran, 2011) and development of e-content is not an easy process (Jegan and Eswaran, 2004). It must be prepared in accordance with students' readiness levels and learning styles (Kantar et al., 2012; Ozerem and Akkoyunlu, 2015). Experts including coordinators, team leaders, producers, art directors, designers, environment compilers, content experts, education technologists, education psychologists, education sociologists, scale and evaluation experts should be involved in the production of e-content (Kultur et al., 2003; Sarac, Kocoglu and Reis, 2011; Karatas and Mahiroglu, 2013). When these experts work cooperatively and in a step-by-step process, e-content can be developed easily and quickly (Utä, 2006).

A large variety of file formats can be used for efficient and enjoyable e-content development (Shiratuddin et al., 2003, p.112). By using files formulated for Flash, Dreamweaver, Captivate, Camtasia, Snagit, Hot Potatoes, EXE, Presenter, iSpring, Articulate, HTML, XML, SGML and more, efficient e-content can be developed (Shiratuddin et al., 2003; Prakashe, 2009; Sarac et al., 2011; Colakoglu, 2013).

The principles of e-content development were determined by considering the principles of web-based education, which were determined by Sarac et al. (2011) and Deperlioglu and Sarpkaya (2009): interoperability, reusability, accessibility and durability. According to these principles, the following steps that should be followed while developing e-content were outlined (Mutlu, 2004; Ozarslan, Kubat and Bay, 2007):

- Determining the educational goals of the course (course's general goal, partial goals, topic explanation, evaluation questions)
- Determining the coverage and flow required to accomplish the educational goal
- Determining the evaluation scales
- Producing the materials to be used in the content
- Building the materials in order to produce educational results
- Making changes according to the feedback on a trial version of the e-content

The use of e-content in the teaching and learning process produces positive outcomes. For instance, Karthikeyan, Jeya-Shanmugaraja and Jeyaraman (2012) revealed the effectiveness of teaching strategies that include e-content and demonstrated an increase in students' active participation in the learning process with this kind of content. Aljaafreh (2009), using the ADDIE (analysis, design,

development, implementation, evaluation) model, developed e-content for an artificial intelligence course for university students and obtained successful results at the study's conclusion.

Countries are continually updating their educational policies in order to provide for the requirements of the times. As a result of contemporary requirements, educational policies are currently being updated to include technology policies. Australia's Digital Education Revolution (2013) had the goal of providing students with an education that equipped them with the most up-to-date technological skills (Digital Education Revolution, 2013). The Portuguese government activated the "Magellan" project in 2008 with the goal of "A well prepared country, according to the global conjuncture" in its Education and Telecommunication Ministry. Under the Magellan project, curriculum-supportive software, environmental hardware and e-content were developed according to students' ages, local language, and regional needs (Magellan, 2013). In 2007-2011, Finland's government undertook the National Information Society Policy project to investigate the use of information and communication technologies in education. The project sought to develop e-content until 2015, providing such content for teachers and students at its edu.fi webpage (National Plan for Educational Use of Information and Communications Technology, 2010). In Turkey, the comprehensive FATİH Project (Turkish abbreviation: Increasing Opportunities and Improving Technology Action) was initiated by the National Ministry of Education to increase the usage of technology in education (Ciftci, Taskaya and Alemdar, 2013, p. 228). One of the most important factors in the integration of information technology equipment with education is the development of e-content items, which is also critical to the application of technological policies to education. E-content is critical for effective technology integration (Canbazoğlu Bilici, Yamak, Kavak, & Guzey et al, 2013). As Juhary (2010) stressed, e-content developers should take into account students' readiness, learning environments and cultural differences, which makes critical for every educational institute to develop its own e-content. Specifically, most education programs point out that teachers are the most responsible players, stating that teachers are in service to develop e-content for use in education (Kollias, 2007). Similarly, Incik and Akay (2015) pointed out that in the process of designing, developing and implementing e-content sources, teachers must play an active role. As Eren and colleagues stated (2014), one reason is that e-content sources developed by organizations other than educational institutions have not met the needs of teachers and students (Eren, Yurtseven Avcı, & Seckin Kapucu, 2014). Although teachers were found to have limited knowledge in e-content development (Banoglu, Madenoğlu, Uysal, and Dede, 2014), they can develop e-content with necessary support (Uluuysal, Demiral, Kurt and Sahin, 2014). In short, for an effective teaching and learning process, teachers must receive support in the development of e-content, and they should play an active role in such development.

The purpose of this study is to develop a scale to determine Turkish teachers' and pre-service teachers' skills to prepare e-content based on the criteria determined by the National Ministry of Education of Turkey (MEB, 2013).

### *Purpose of the Research and Problem*

The purpose of this study is to develop a valid and reliable Likert-type scale that will determine pre-service teachers' e-content preparation skills according to the criteria determined by the Ministry of Education. The scale that will be developed at the conclusion of this study is designed for use not only by pre-service teachers but also in-service teachers to determine their e-content preparation skills. We have accepted that the criteria determined by the Ministry of Education are sufficient to determine e-content preparation skills.

## **Method**

### *Research Model*

The research was conducted in the 2011-2012 school year in the Faculty of Education in a state university located in eastern Turkey. Screening research is a research model that provides answers to questions such as "What, where, when, how often, on which level" in a universe that consists of large communities with the goal of determining the opinions and specialties of the universe (Buyukozturk et al., 2012).

### *Research Sample/Working Group*

The purposeful sampling method was used to select the participants. For exploratory factor analysis, participants consisted of 226 pre-service teachers (114 male, 112 female) from the Department of Computer and Instructional Technologies of a state university located in eastern Turkey. In addition, 588 teacher candidates (245 male and 343 female) were randomly selected for confirmatory factor analysis. According to Kline (1994), the sample size should be at least two times and at most ten times the instrument's number of items.

### *Data Analysis*

In this study, the descriptive analysis method was employed (Buyukozturk et al., 2012). The instrument was online and took almost 15 minutes for participants to fill out. The collected data were imported to a statistical program, and analyses were completed.

When analyzing the scale's validity and reliability analysis, respectively, convenience according to factor analysis, item analysis, exploratory factor analysis, Cronbach's alpha and split-half value calculation was applied.

Extracted factors based on the preliminary results of exploratory analysis were crosschecked using confirmatory factor analysis, regarded as a well-accepted approach to determine discriminant and convergent validity (Anderson and Gerbing, 1988), with a variety of fit-indexes. Although either exploratory factor analysis or confirmatory factor analysis can be preferred individually, it is a plausible and recommended approach to employ both types of analyses subsequently. As one of the best factor retention approaches, exploratory factor analysis can serve as an

initial study by mitigating a wide range of indicators to a more controllable set (Anderson & Gerbing, 1998).

In judging the fit of the confirmatory factor analysis model, a variety of goodness of fit indexes were examined: Chi-Square ( $\chi^2$ ), df (degrees of freedom), CFI (Comparative Fit Index), NFI (Normed Fit Index), NNFI (Non-normed fit index), GFI (Goodness of Fit Index), AGFI (Adjusted Goodness of Fit Index), RMSEA (Root Mean Square Error of Approximation), SMRM (Standardized Root Mean Square Residual), and p-value. These indices are expected to meet their own particular criteria as determined by Buyukozturk, Akgun, Kahveci and Demirel, 2004 and Yilmaz, Celik and Ekiz, 2006.

#### *Structure of the Scale*

The scale to determine pre-service teachers' e-content preparation skills is a Likert-type one. The answers to items in the scale are organized as follows: 5= Strongly Agree, 4= Agree, 3= Neutral, 2= Disagree, 1= Strongly Disagree.

While rating the items, the scale for positive expressions was inverted for negative ones (5 points for strongly disagree, for example) in order to acquire numbers for analysis.

#### *Item Analysis*

Item analysis can be conducted in order to uncover the effect of items to build the scale to the total scale point and in order to determine the relation of the items in the complete scale (Tuna, Bircan and Yesiltas, 2012). In the item analysis, it is recommended that items with an item-total correlation value of 0.30 or lower are extracted when content validity is considered (Buyukozturk, 2011; Tavsancil, 2002) For all of the items in the scale, an item-total value between 0.51 and 0.80 and t-value ( $p < .001$ ) was determined as meaningful. According to that result, it can be said that the reliability of the scale's items is high and appropriate to evaluate the same behavior. This finding shows that the items are distinguished to determine e-content preparation skills.

#### *Determining the Content Validity*

Content validity is an indicator of the adequacy of the items as evaluated by the intended specialties (Buyukozturk, Kılıc Cakmak, Akgun, Karadeniz and Demirel, 2012). The criteria that were provided by National Ministry of Education of Turkey for development of e-content and e-books were used in order to create items. Two faculty members and two in-service teachers with expertise in computer education evaluated the items. The items that were qualified as inappropriate and/or damaging to the appearance of validity were removed from the scale tool in accordance with the experts' feedback. In addition, the final version of this scale was evaluated by a language expert in terms of its grammar and clarity.

*Testing of Data's Analysis Convenience*

Factor analysis is a statistical method to divide variables according to the relation between them in lesser sets (Khalaf, 2007). The Kaiser-Meyer-Olkin (KMO) method is a criterion to determine the sample's size convenience for factor analysis (Cokluk, Sekercioglu and Buyukozturk, 2012). A KMO value must be larger than 0.70 to be factored (Leech, Barrett and Morgan, 2005). Bartlett's test of sphericity is a statistical test that evaluates whether the data have multiple variables (Kan and Akbas, 2005). According to the tests, which were conducted to determine the convenience of data and samples for factor analysis, the KMO value was determined to be .947 and the results of Bartlett's test of sphericity were .000 ( $p < 0.001$ ) meaningful. These results demonstrate that the data are suitable for factor analysis.

*Findings about the Structure Validity*

Exploratory Factor Analysis. After testing the scale's convenience for factor analysis, the maximum likelihood method was used for exploratory factor analysis. As a result of the studies conducted, Table 1 reveals that of the 48 items under the study's seven factors had an eigenvalue larger than 1. The variance of these seven factors on the scale is 74.23%. The nine items that had a high load value in more than one factor were extracted.

**Table 1.***Factor Load of Scale for E-Content Preparation Skills*

Item	Factor Load	Average	SS	Item- Correlation	Total
<b>1. Factor (Educational and Design Criteria) (Explained Variance: 15.92)</b>					
Item 1	.550	3.6903	.83352	.724	
Item 2	.654	3.6726	.82669	.685	
Item 3	.584	3.6239	.83008	.751	
Item 4	.722	4.0531	.70352	.513	
Item 5	.686	3.7522	.80588	.532	
Item 6	.754	3.8850	.75132	.618	
Item 7	.722	4.0442	.77619	.664	
Item 8	.709	3.9602	.78497	.714	
Item 9	.690	3.8142	.80054	.585	
Item 10	.696	3.9381	.73977	.672	
Item 11	.714	3.9469	.72223	.716	
Item 12	.702	4.0221	.68925	.643	
Item 13	.672	4.0310	.68891	.638	
<b>2. Factor (Technical Criteria) (Explained Variance: 12.19)</b>					
Item 14	.552	4.0531	.80296	.638	
Item 15	.629	3.7522	.85279	.731	
Item 16	.525	3.8850	.85651	.754	
Item 18	.501	3.9602	.91142	.738	

Table 1 Continue

Item 21	.584	3.9469	.92436	.695
Item 30	.646	3.8319	1.05287	.559
Item 38	.717	3.8142	1.00273	.623
Item 39	.606	3.5398	.96325	.737
Item 40	.610	3.3230	.95256	.739
3. Factor (Animation Criteria) (Explained Variance: 12.18)				
Item 28	.578	3.5841	.92903	.701
Item 29	.621	3.8319	1.07112	.684
Item 31	.672	3.3628	.97315	.789
Item 32	.662	3.8230	.90622	.805
Item 33	.715	3.7743	.89839	.785
Item 34	.675	3.7743	.90827	.792
Item 35	.703	3.6681	.87671	.771
Item 36	.657	3.6372	.84752	.767
Item 37	.509	3.7345	.90310	.804
4. Factor (Video Criteria) (Explained Variance: 11.85)				
Item 22	.714	4.0221	.87158	.667
Item 23	.783	4.0310	.86279	.705
Item 24	.705	3.5796	.85762	.787
Item 25	.688	3.5619	.90458	.804
Item 26	.687	3.6814	.86474	.742
Item 27	.633	3.7345	.83817	.765
5. Factor (Scale and Evaluation Criteria) (Explained Variance: 9.44)				
Item 52	.750	3.8982	3.8982	.680
Item 53	.762	3.9381	3.9381	.691
Item 54	.651	3.7522	3.7522	.722
Item 55	.604	3.8451	3.8451	.741
Item 56	.508	3.8009	3.8009	.666
6. Factor (Graphic and Photograph Criteria) (Explained Variance: 7.85)				
Item 41	.635	3.6549	3.7876	.665
Item 42	.626	3.6283	3.7920	.765
Item 44	.612	3.7566	3.7345	.781
7. Factor (Sound Criteria) (Explained Variance: 4.78)				
Item 17	.516	4.0442	3.7345	.751
Item 19	.566	3.8142	3.8319	.732
Item 20	.573	3.9381	3.8319	.721

The factor load that was determined after the Varimax rotation was accepted as "between 0,32-0,44=bad", "between 0,45-0,54=normal", "between 0,55-0,62=good", "between 0,63-0,70= very good" and "0,70 and above=perfect" (Comrey and Lee, 1992; Transmitter: Dede and Yaman, 2008). The acquired Varimax rotation factor loads were determined as "normal" for 5 items, "good" for 11 items, "very good" for 19 items and "perfect" for 10 items in Table 2.

**Table 2.***Explained Total Variance and Eigenvalue of the Factors*

Factors	Factor Eigenvalue	Explained Variance %	Factor Explained Variance %	Total
Educational and Design Criteria	29.714	15.924	15.924	
Technical Criteria	3.679	12.191	28.115	
Animation Criteria	2.237	12.186	40.301	
Video Criteria	1.995	11.851	52.152	
Scale and Evaluation Criteria	1.492	9.449	61.601	
Graphic and Photograph Criteria	1.312	7.854	69.455	
Sound Criteria	1.142	4.78	74.234	

The explained variance amount of the solution collected in these seven factors is 74.23%. The factors' eigen values and explained variance amounts can be seen in Table 2.

*Confirmatory factor analysis.* A maximum likelihood confirmatory factor analysis using the items previously established with exploratory factor analysis was conducted. The final results of the confirmatory factor analysis indicated an acceptable model for all fit indices including Chi-square (e.g.,  $\chi^2 = 5205.04$ ;  $df = 1057$ ;  $\chi^2/df = 4.92$ ,  $p=0.00$ ). According to Buyukozturk et al. (2004), a ratio of  $\chi^2/df$  under 5 can be regarded as acceptable. This study's RMSEA and RMR values were calculated as 0.08 and 0.04, respectively. RMSEA and RMR indices under 0.08 are seen as acceptable (Yilmaz et al., 2006). In addition, CFI and NNFI indexes, which are important to reveal the fit of the model, should be over 0.95 (Buyukozturk et al., 2004). In this study, we found acceptable values for those indexes (CFI=0.98; NNFI=0.98). Thus, we obtained acceptable values for the goodness of fit indices based on the confirmatory factor analysis model. The factor loadings of the model and path diagram are presented in Figure 1.

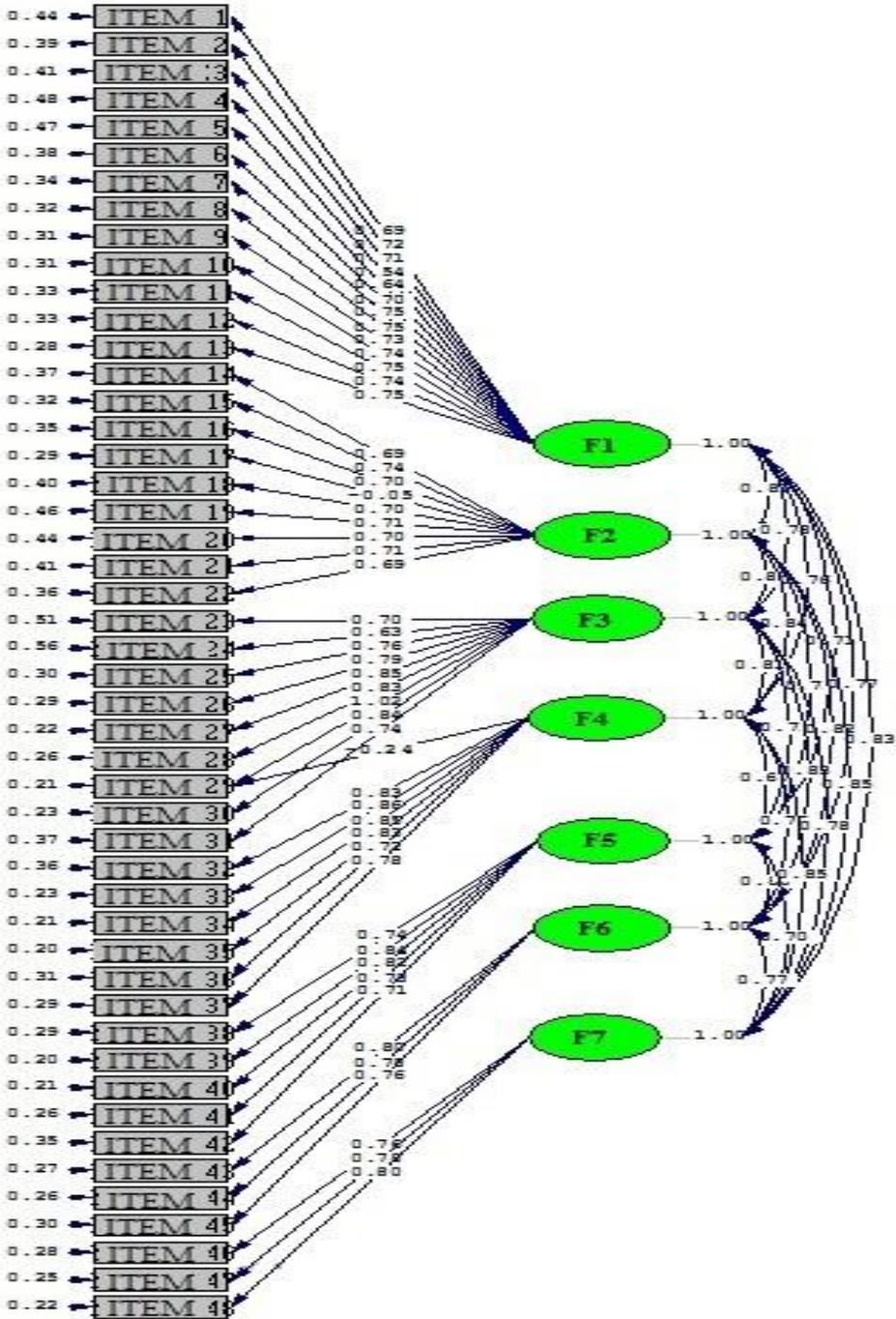


Figure 1. The factor loadings of the model and path diagram

### *Scale's Reliability Studies*

There are several methods to test the reliability of a scale, including test-retest, parallel forms, split-half, internal consistency, and so forth (Buyukozturk, 2011). In this study, the reliability of the "E-content Preparation Skills" survey was calculated via an internal consistency test (Cronbach's alpha) and the split-half method. Cronbach's alpha coefficients are determined as "unacceptable between 0-0.49", "controversial between 0.5-0.59", "normal between 0.6-0.69", "acceptable between 0.7-0.79", "good between 0.8-0.89" and "perfect between 0.9-1" (George and Mallery, 2003; Transmitter: Gliem and Gliem, 2003). The Cronbach's alpha internal consistency coefficient value for the e-content preparation skills survey was determined to be  $\alpha=0.98$ . The coefficient that was found using the split-half method was 0.92. In conclusion, then, the e-content preparation skills survey is a reliable scale.

### **Discussion and Conclusion**

In this study, an e-content preparation skills survey was checked for validity and reliability. The scale was developed based on the criteria announced by Turkey's Ministry of Education. The study was completed with two sets of participants: 226 teacher candidates for exploratory factor analysis, and 588 teacher candidates for confirmatory factor analysis.

The validity and reliability tests of the scale were developed in accordance with the criteria of e-content published by MEB and were conducted on teacher candidates. Experts inspected the draft scale that was prepared through the validity study, and items that were qualified as inappropriate or damaging to the appearance of validity were extracted. According to exploratory factor analysis, items with a load value of less than 0.45 and items with a high load value in two items were extracted from the draft scale. The scale has demonstrated a seven-factor structure after repeated exploratory factor analysis, and these seven factors provided an explained variance for 74.23% of the scale.

As a result of exploratory factor analysis, seven factors were acquired: Educational and Design Criteria, Technical Criteria, Animation Criteria, Video Criteria, Scale and Evaluation Criteria, Graphic and Photograph Criteria, and Sound Criteria. Eren, Avcı and Kapucu (2014) created a scale with a single-dimensional structure that consists of 26 items to determine pre-service teachers' proficiency at using practical content developing technologies and the requirements for using these technologies. The single dimensioned factor regarding the scale has a variance of 38.91%, and the reliability coefficient of the scale is  $\alpha=0.94$ .

Sendag and Gunduz (2007) evaluated the efficiency and usability of learning materials that were developed for a development and learning course. Pre-service teachers provided answers above 3.40 and below 4.20 about color coherence, readability and understandability related to a text's page layout factors. These results reveal parallels with the e-content preparation skills scale's Educational and Design Criteria: the results are above 3.60 and below 4.05 when the arithmetic mean of the Educational and Design Criteria's items are examined. Similarly, participants had general suggestions about design format (color, coherence and screen interface) in reviews of e-content materials' usability created by Sener (2005). This result

demonstrates that Educational and Design Criteria of e-content preparation skills have important implications. In the same study, the requirement to increase visual and dynamic expressions was pointed out in relation to Animation Criteria and Sound-Graphic Criteria. In accordance with Sener's (2005) work, the pre-service teachers were attentive to animated, visual and audio elements in the study carried out by Erumit (2013). In Cure and Ozdener's study (2008), named "Teachers' Information and Communication Technologies (ICT) Using Achievements and Attitudes towards ICT", they undertook a practical examination to determine the ICT usage levels of teachers. As a result of the examination, the teachers' abilities using the technical criteria of the e-content preparation skills scale, looking at tasks such as recording sounds on the computer and adding video and sound, rated below 50%. However, when related answers in the e-content preparation skills scale's technical criteria section were analyzed, it was determined that the mathematical mean of the answers was above 3.32 and below 4.05 except for one item in the "Disagree" section. The development of technology in recent years likely effected these results. In the study conducted by Ari, Eren, Cam, Akifova and Tahirova (2014), which contained e-evaluation materials regarding secondary school fifth grade courses, teachers from different branches completed the evaluations. The study pointed out that a variety of exercises should be present in materials based on the advice of teachers about the amendments aspect of e-evaluation materials. The e-content preparation skills scale's Scale and Evaluation Criteria are analogous to different types of question in developed e-content.

Considering the acceptable levels of goodness of fit indexes acquired through confirmatory factor analysis, the seven-factor construct based on exploratory factor analysis appears to be confirmed. The internal consistency coefficient (Cronbach's alpha) was determined to be 0.98, meaning that the survey's internal consistency had a "perfect" value. The analyzed items' total correlation changes between 0.52 and 0.80. In conclusion, the survey items had high reliability with the goal of evaluating the same behavior according to the gathered data.

Although the reliability coefficient has a "perfect" value in terms of the internal consistency coefficient and test halving methods, the survey's reliability coefficient can be re-calculated with the testing-re-testing method. It's possible to build a new course in higher education or update an existing one for today's requirements by examining pre-service teachers' e-content preparation skills using the developed scale. It's also possible to arrange internal education for in-service teachers by examining their e-content preparation skills in accordance with emerging needs.

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## E-içerik Hazırlama Becerileri Ölçeği:Geliştirme, Geçerlilik ve Güvenirlilik

### Atf:

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### Özet

*Problem Durumu:* Bilgi ve iletişim teknolojileri alanındaki değişim ve gelişimler her alanda olduğu gibi eğitim alanında da etkili olmaktadır. Teknolojinin etkisiyle eğitimde yeni yöntemler ortaya çıkmaktadır. Bu yeni yöntemlerden biri de e-öğrenmedir. E-öğrenme ile eğitim-öğretim sürecinin yanı sıra ders materyalleri de değişime uğramıştır. E-öğrenme ortamlarında, dijital teknolojiler kullanılarak geliştirilen elektronik eğitim kaynağı olan e-içerikler kullanılmaktadır.

Ülkeler, çağın gereksinimlerini karşılamak amacıyla eğitim politikalarını sürekli güncellemektedirler. Bu gereksinimlerin bir sonucu olarak eğitimde teknoloji politikaları geliştirilmektedir. Ülkelerin eğitimde teknoloji politikaları incelendiğinde, e-içerik geliştirme sürecinin, projelerin başarıya ulaşmasında önemli bir etkiye sahip olduğu görülmektedir. Bu çalışmanın amacı öğretmen adaylarının e-içerik hazırlama becerilerini belirleyecek geçerli ve güvenilir, Likert tipi bir ölçme aracı geliştirmektir. Bu çalışma sonunda geliştirilecek ölçeğin, öğretmen adaylarının yanı sıra görevde olan öğretmenlerinde e-içerik hazırlama becerilerinin belirlenmesi için de kullanılabilceği düşünülmektedir.

*Araştırmanın Yöntemi:* Araştırma, 2011-2012 eğitim-öğretim yılında, Türkiye'nin doğusunda yer alan bir üniversitede tarama yöntemiyle yapılmıştır. Katılımcıların seçiminde amaçlı örnekleme yöntemi kullanılmıştır. Açıklayıcı faktör analizi çalışmasının örneklemini, Türkiye'nin doğusunda yer alan bir üniversitenin Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü'nde öğrenim göre 2. 3. ve 4. sınıf öğrencilerinden, seçkisiz yöntemle belirlenmiş 226 (114 erkek, 112 kadın) öğretmen adayı oluşturmaktadır. Doğrulayıcı faktör analizi çalışmasının örneklemini ise Türkiye'nin doğusunda yer alan bir üniversitenin Eğitim Fakültesi'nde öğrenim gören seçkisiz yöntemle belirlenmiş 588 (245 erkek, 343 kadın) öğretmen adayı oluşturmaktadır. Ölçeğin kapsam geçerliliğini belirlemek amacıyla uzman görüşlerine başvurulmuştur. Uzman görüşleri alınan ölçeğin geçerlilik analizleri kapsamında sırasıyla verilerin faktör analizine uygunluğu, madde analizi, açıklayıcı faktör analizi çalışmaları gerçekleştirilmiştir. Ayrıca Açıklayıcı Faktör Analizi sonucunda ortaya çıkan modelin, yapı geçerliliğini değerlendirmek amacıyla Doğrulayıcı Faktör Analizi gerçekleştirilmiştir. Ölçeğin güvenilirliğini belirlemek

amacıyla ise Cronbach Alpha İç Tutarlılık katsayısı ve test yarılama değerinin hesaplanması işlemleri gerçekleştirilmiştir.

*Araştırmanın Bulguları:* Geçerlilik çalışması kapsamında hazırlanan taslak ölçek, Eğitim Fakültesi BÖTE Bölümündeki iki öğretmen tarafından incelenmiştir. Kapsama uygun olmayan veya görünüş geçerliliğini düşüren maddeler ölçekten çıkartılmıştır. Yapı geçerliliğini belirlemek amacıyla açımlayıcı faktör analizi yapılmıştır. Verilerin ve örneklemin açımlayıcı faktör analizine uygunluğunun incelenmesi amacıyla yapılan testler sonucunda KMO değeri .947 ve Bartlett Küresellik testi sonucu .000 ( $p < 0.0001$ ) anlamlı olduğu görülmüştür. Bu sonuçlar verilerin açımlayıcı faktör analizi yapılmaya uygun olduğunu göstermektedir. Yapılan faktör analizi çalışmasında faktör yük değeri 0.45 altında olan ve iki faktörde yüksek yük değerine sahip maddeler taslak halindeki ölçekten çıkartılmıştır. Tekrar gerçekleştirilen açımlayıcı faktör analizi çalışmasında yedi faktörlü bir yapı sergilediği görülmüştür ve bu yedi faktör ölçeğe ilişkin %74,23'lük bir varyansı açıklamıştır. Açımlayıcı Faktör Analizi sonucunda ortaya çıkan yedi faktörlü modelin, yapı geçerliliğini değerlendirmek amacıyla Doğrulayıcı Faktör Analizi gerçekleştirilmiştir. E-içerik Geliştirme Becerileri ölçeğine ilişkin olarak gerçekleştirilen doğrulayıcı faktör analiz sonuçları incelendiğinde Ki-Kare değerinin ( $X^2=5208.04$ ,  $N=588$ ,  $sd=1057$ ,  $p=0,00$ ) anlamlı olduğu görülmektedir. Bu değerler oranlandığından  $X^2/sd$  oranının 4,92 olduğu görülmektedir. RMSEA ve RMR değeri incelendiğinde ise RMSEA= 0,08 ve RMR=0.04 düzeyinde bir uyum indeksi olduğu görülmektedir.). Diğer uyum indeksleri olan CFI ve NNFI incelendiğinde; CFI=0.98 ve NNFI=0.98 olduğu görülmektedir. Analiz sonuçlarına göre modelin kabul edilebilir düzeyde uyuma sahip olduğu görülmektedir. Ölçeğin tamamı için hesaplanan iç tutarlık katsayısı (Cronbach Alpha) 0.98 olarak bulunmuştur. Bu sonuç E-içerik geliştirme becerileri anketinin iç tutarlılığının "Mükemmel" derecede olduğunu göstermektedir. Analiz edilen madde toplam korelasyonları ise 0.52 ve 0.80 arasında değişmektedir. Elde edilen veriler ankette yer alan maddelerin güvenilirliklerinin yüksek ve aynı davranışı ölçmeye yönelik olduğu göstermiştir.

*Araştırmanın Sonuçları ve Önerileri:* Bu çalışmada, E-içerik Hazırlama Becerileri anketinin geçerlilik ve güvenilirlik çalışması gerçekleştirilmiştir. Açımlayıcı faktör analizi sonucunda, Eğitsel ve Tasarım Kriterleri, Teknik Kriterler, Animasyon Kriterleri, Video Kriterleri, Ölçme ve Değerlendirme Kriterleri, Grafik ve Fotoğraf Kriterleri ve Ses Kriterlerinden oluşan yedi faktörlü bir ölçek elde edilmiştir. Doğrulayıcı faktör analiz için uyum indeksleri ve standart değerler göz önüne alındığından modelin iyi düzeyde uyum verdiği ve açımlayıcı faktör analiziyle ortaya konan yedi faktörlü yapının uygunluğunu işaret etmektedir. Geliştirilen ölçekle öğretmen adaylarının e-içerik hazırlama becerileri değerlendirilebilir. Elde edilen sonuçlara göre, öğretmen adaylarının e-içerik geliştirme becerileri geliştirme amacıyla yüksek öğretimde yeni bir ders oluşturulabilir veya var olan bir ders içerikleri güncellenebilir. Ayrıca görevde bulunan öğretmenlerin de e-içerik hazırlama becerileri değerlendirilerek ihtiyaçlar doğrultusunda öğretmenlere hizmet içi eğitimler verilebilir.

*Anahtar Kelimeler:* e-içerik, öğretmen adayları, geçerlilik ve güvenilirlik, e-içerik hazırlama becerileri.